

Table 11.1 - Emissions from Electricity Generators

(Thousand short tons of gas)

	<u>1990</u>	<u>2000</u>	<u>2001</u>	<u>2010</u>	<u>2020</u>	<u>2025</u>
Coal Fired						
Carbon Dioxide	1,686,800	2,101,599	2,046,958	2,344,058	2,625,393	2,806,078
Sulfur Dioxide	15,220	10,597	9,955	NA	NA	NA
Nitrogen Oxide	5,642	4,536	4,169	NA	NA	NA
Methane	11	13	13	NA	NA	NA
Nitrous Oxide	25	31	31	NA	NA	NA
Petroleum Fired						
Carbon Dioxide	109,139	99,339	111,160	35,571	39,209	44,060
Sulfur Dioxide	639	472	525	NA	NA	NA
Nitrogen Oxide	221	161	163	NA	NA	NA
Methane	1	1	1	NA	NA	NA
Nitrous Oxide	1	1	1	NA	NA	NA
Gas Fired						
Carbon Dioxide	193,539	309,436	314,077	403,813	557,012	626,537
Sulfur Dioxide	1	173	199	NA	NA	NA
Nitrogen Oxide	565	421	364	NA	NA	NA
Methane	0 ¹	0 ¹	0 ¹	NA	NA	NA
Nitrous Oxide	0 ¹	0 ¹	0 ¹	NA	NA	NA
Other						
Carbon Dioxide	NA	NA	NA	NA	NA	NA
Sulfur Dioxide ²	49	146	142	NA	NA	NA
Nitrogen Oxide ²	235	194	195	NA	NA	NA
Methane	NA	NA	NA	NA	NA	NA
Nitrous Oxide ³	0 ¹	1	1	NA	NA	NA
Total						
Carbon Dioxide	1,989,963	2,510,253	2,472,599	2,783,038	3,221,210	3,476,675
Sulfur Dioxide	15,909	11,388	10,821	9,570	8,950	8,950
Nitrogen Oxide	6,663	5,311	4,891	3,920	4,060	4,120
Methane	12	14	14	NA	NA	NA
Nitrous Oxide	28	33	33	NA	NA	NA
Sulfur Hexafluoride ⁴	2	1	1	NA	NA	NA

Sources: EIA, *Annual Energy Outlook 2003*, DOE/EIA-0383(2003) (Washington, D.C., January 2003), Tables A8 and A19, EIA, *Emissions of Greenhouse Gases in the United States 2001*, DOE/EIA-0573(2001) (Washington, D.C., December 2002) Tables 10, 17, 25, 29, and EPA, *National Emission Inventory - Air Pollutant Emission Trends, "Average Annual Emissions, All Criteria Pollutants"*, February 2003, <http://www.epa.gov/ttn/chief/trends/index.html>.

Notes:

Emissions from electric power sector only.

¹ Emissions total less than 500 tons.

² Emissions from plants fired by other fuels; includes internal combustion generators.

³ Emissions from wood burning plants.

⁴ Sulfur hexafluoride (SF₆) is a colorless, odorless, non-toxic, and non-flammable gas used as an insulator in electric T&D equipment. SF₆ has a 100-year global warming potential that is 22,200 times that of carbon dioxide and has an atmospheric lifetime of 3,200 years.

Table 11.2 - Installed Nameplate Capacity of Utility Steam-Electric Generators With Environmental Equipment

(Megawatts)

	<u>1990</u>	<u>2000</u>
Coal Fired		
Particulate Collectors	315,681	321,636
Cooling Towers	134,199	146,093
Scrubbers	69,057	89,675
Total ¹	317,522	328,741
Petroleum and Gas Fired		
Particulate Collectors	33,639	31,090
Cooling Towers	28,359	29,427
Scrubbers	65	0
Total ¹	59,372	57,697
Total		
Particulate Collectors	349,319	352,727
Cooling Towers	162,557	175,520
Scrubbers	69,122	89,675
Total ¹	376,894	386,438

Source: EIA, *Annual Energy Review 2001*, DOE/EIA-0384(2001) (Washington, D.C., November 2002), Table 12.7.

Notes:

¹Components are not additive because some generators are included in more than one category.

2000 data are preliminary.

Data cover only plants with fossil-fuel steam-electric capacity >100 MW.

Table 11.3 - EPA-Forecasted Nitrogen Oxide, Sulfur Dioxide and Mercury Emissions from Electric Generators

	Original Cases ¹			Revised Cases ²		
	<u>2000</u>	<u>2005</u>	<u>2010</u>	<u>2000</u>	<u>2005</u>	<u>2010</u>
NO _x (Thousand Tons)						
Base Case ³	6,066	6,487	6,272	5,972	6,386	6,458
Worse Case ⁴	6,407	6,891	7,176	6,316	6,854	7,113
Better Case ⁵	5,993	6,108	6,052	NA	NA	NA
SO ₂ (Thousand Tons)						
Base Case ³	10,716	10,880	9,408	10,216	10,442	10,002
Worse Case ⁴	10,257	10,647	9,763	10,257	10,653	9,862
Better Case ⁵	11,037	10,807	9,323	NA	NA	NA
Mercury (Tons)						
Base Case ³	60.0	64.5	60.7	60.9	66.1	67.4
Worse Case ⁴	63.3	66.9	68.1	62.8	70.6	75.9
Better Case ⁵	58.9	60.3	59.3	NA	NA	NA

Source: Environmental Protection Agency (EPA), EPA's Forecast of Electric Power Generation and Air Emissions, Original Cases: Tables 4, 8, and 11, <http://www.epa.gov/capi/capi/frcsttbl.html> and Revised Cases: <http://www.epa.gov/capi/capitbls.html>

Notes:

¹ As part of the Clean Air Power Initiative (CAPI), the U.S. Environmental Protection Agency prepared three forecasts of electric power generation and air emissions from 2000 to 2010. The Agency summarized the forecasts' results at the CAPI Forum in April 1996.

² Based on comments received from the CAPI Forum, the Agency prepared revised forecasts for the Base Case and Higher Emissions Case that were published in July 1996. The revision process also included updating portions of the analysis where better information has recently become available, such as natural gas prices and nuclear capacity factors.

³ Base Case (original and revised) includes: the NERC forecast electric demand growth adjusted for the Climate Change Action Plan, 15-20% reserve margins, 75% transmission transfer capacity, 65 year limit of >50 MW coal plants, minor reduction in nuclear capacity to 90 GW, fossil plant availability increases to 85%, combined cycle heat rates reduce to 5,687 Btu/kWh, nonhydro renewables based on AEO96.

⁴ Worse Case (original and revised) is similar to the Base Case with the following key differences: 25% reduced demand, 13-18% reserve margins, 80% transmission transfer capacity, 80 year limit on >50 MW coal plants, greater reduction in nuclear capacity to 84 GW, fossil plant availability increases to 90%, combined cycle heat rates reduce to 6752 Btu/kWh.

⁵ Better Case (original and revised) is similar to Base Case, but adjusts for Climate Change with a greater reduction in demand, 70% reserve margins, 60 year limit on >50 MW coal plants, and non-hydro renewables with 40% cost reduction by 2005.

Table 11.4 - Market Price Indices for Emissions Trading in the South Coast Air-Quality Management District

	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2005</u>	<u>2010</u>
Market Price Indices ¹								
RECLAIM Trading Credit (\$/lb) ²								
Nitrogen Oxide	0.05	0.08	0.20	0.90	42.69	11.11	6.95	6.58
Sulfur Dioxide	0.15	0.08	0.34	0.29	1.14	6.82	4.73	4.73
Emission Reduction Credit (\$/lb/day) ³								
Nitrogen Oxide	2,070	2,908	4,515	4,560	7,675	16,809	NA	NA
Sulfur Dioxide	1,367	1,740	1,687	1,687	3,721	7,184	NA	NA
Particulate Matter (<10 microns)	2,418	1,947	1,981	3,175	6,942	19,030	NA	NA
Reactive Organic Gas	1,075	754	744	735	1,904	1,869	NA	NA
Carbon Dioxide	NA	NA	NA	NA	1,000	7,259	NA	NA

Source: Cantor Fitzgerald EBS, SCAQMD RTC/ERC MPI History, <http://www.emissionstrading.com>.

Notes:

¹ Market Price Indices (MPIs) reflect current market conditions for a particular date. Dates used here are end of year: 11/12/96, 12/29/97, 12/21/98, 12/27/99, 12/28/00, and 12/7/01. 2005 and 2010 prices as of 12/7/01. Prices are an average of the most recent price, lowest bid, and highest bid for RTC and ERC transactions executed by Cantor Fitzgerald and/or reported by the South Coast Air Quality Management District (SCAQMD) for 2,000 pounds or more of RTCs or 10 lbs/day or more of ERCs. SCAQMD was chosen because it is the region with the greatest number of emissions traded.

² In the RECLAIM program, the RECLAIM Trading Credit (RTC) is a limited authorization to emit a RECLAIM pollutant in accordance with the restrictions and requirements of the RECLAIM rules. Each RTC has a denomination of one pound of RECLAIM pollutant and a term of one year, and can be held as part of a facility's Allocation or alternatively may be evidenced by an RTC Certificate.

³ Emissions Reduction Credits (ERCs) are reductions in emissions that have been recognized by the relevant local or state government air agency as being real, permanent, surplus, and enforceable. ERCs are usually measured as a weight over time (e.g., pounds per day or tons per year). Such rate-based ERCs can be used to satisfy emission offset requirements of new major sources and new major modifications of existing major sources.

Table 11.5 - Origin of 2001 Allowable SO₂ Emissions Levels

Type of Allowance Allocation	Number of Allowances	Explanation of Allowance Allocation Type
Initial Allocation ¹	9,190,922	Initial Allocation is the number of allowances granted to units based on the product of their historic utilization and emissions rates (performance standards) specified in the Clean Air Act.
Allowances for Substitution Units	13,547	A lawsuit settlement allowed for a small amount of allowances to be allocated for Substitution Units in 2001 instead of an earlier year during Phase I.
Allowance Auctions	250,000	Allowance Auctions provide allowances to the market that were set aside in a Special Allowance Reserve when the initial allowance allocation was made.
Opt-in Allowances	99,188	Opt-in Allowances are provided to units entering the program voluntarily. There were 11 opt-in units in 2001.
TOTAL 2001 ALLOCATION	9,553,657	
Banked Allowances	10,376,426	Banked Allowances are those held over from 1995 through 2000 which can be used for compliance in 2001 or any future year.
Conservation and Renewable Energy Allowances	3,528	These allowances come from a special reserve set aside when the initial allowance allocation was made. They are awarded to utilities that undertake efficiency and renewable energy measures. These are year 1999 allowances that were allocated in year 2001.
TOTAL 2001 ALLOWABLE	19,933,611	

Source: EPA, *Acid Rain Program: Annual Progress Report 2001*, Document EPA-430-R-02-009, Figure 5.

Note:

¹ The total year 2001 initial allocation was 9,191,897. 54 allowances were deducted as offsets during year 2000 reconciliation, and 921 allowances were surrendered as part of an enforcement action prior to the 2001 reconciliation.